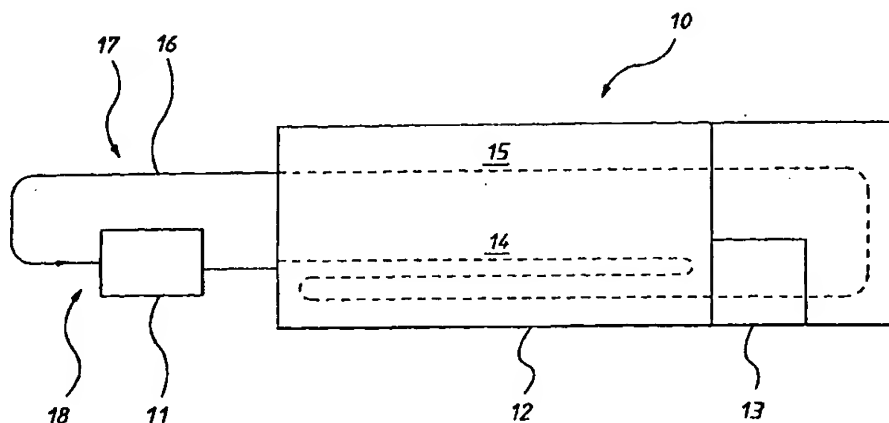




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(21) International Application Number: PCT/AU99/00299 (22) International Filing Date: 21 April 1999 (21.04.99) (30) Priority Data: PP 3094 21 April 1998 (21.04.98) AU (71) Applicant (for all designated States except US): DORIC PRODUCTS PTY. LTD. [AU/AU]; 46-48 Redfern Street, Wetherill Park, NSW 2164 (AU). (72) Inventor; and (75) Inventor/Applicant (for US only): ALCHIN, Michael, Brian [AU/AU]; 65 Oxley Drive, Mittagong, NSW 2575 (AU). (74) Agent: SPRUSON & FERGUSON; G.P.O. Box 3898, Sydney, NSW 2001 (AU).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>

(54) Title: METHOD OF COATING ARTICLES OF PLASTICS MATERIAL



(57) Abstract

A method of coating plastics articles with polyester powder material. The method includes a production line (10) having a conveyor (16). The conveyor (16) conveys the articles to be coated through a pre-heating oven portion (14) which pre-heats the articles to a temperature of about 130 to 135 °C. The articles are then conveyed through a powder coating booth (13) which applies the powder to the articles. The articles are then cured in an oven curing portion (15) at a temperature of about 190 to 215 °C. The items being coated are pre-heated to a temperature of approximately the melting point of the plastics material being applied.

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METHOD OF COATING ARTICLES OF PLASTICS MATERIAL

Technical Field

The present invention relates to polyester powder coating of articles and more particularly to the powder coating of articles of plastics material.

5 Background of the Invention

Polyester powder coating provides objects with a very durable and high quality finish. The process is relatively simple and is a "dry" process.

The method of applying powder coating is an electrostatic process. The article to be coated is charged and the gun which dispenses the powder, charges the powder so that it is attracted to the article to be coated. The powder coated article is then baked in an oven at a temperature that cures the powder. This is generally around 230°C.

Because powder coating is an electrostatic process, it is only used in respect of articles formed of electrically conductive material, such as metal.

Powder coating is not an accepted method of applying finishes to articles formed of plastics material. This is because the articles do not readily accept a charge and secondly, the cure temperatures are too high and can result in destruction and/or distortion of the article.

Accordingly, only wet paint and similar types of finishes are applied to articles formed of plastics material. These methods usually require the article to be etched, this enables the paint to adhere to the article. These techniques have yet to provide a satisfactory high quality finish to items formed of plastics material.

Object of the Invention

It is the object of the present invention to overcome or substantially ameliorate the above disadvantages.

25 Summary of the Invention

There is disclosed herein a method of forming a polyester coating on at least a portion of an article of plastics material reinforced with fibre, said method including the steps of:

- providing said article;
- 30 pre-heating said article to a predetermined temperature, which predetermined temperature is at least equal to the melting temperature of polyester powder which is to form the coating;
- providing a stream of said powder;
- directing said stream at said portion to apply the powder thereto whereupon
- 35 said powder melts to form said coating; and
- curing the coating.

Curing of the coating may be achieved by maintaining the coating at a temperature of about 280° for at least 20 minutes, more preferably the coating is maintained at about 280° for approximately 30 minutes.

Preferably, the curing is at a temperature of 190°C to 215°C, most preferable about 206°C.

Brief Description of the Drawing

Preferred forms of the present invention will now be described by way of example with reference to the accompanying drawings wherein:

Figure 1 is a schematic depiction of a production line to power coat articles formed of plastics material; and

Figure 2 is a schematic depiction of a further production line to power coat articles formed of plastics material.

Detailed description of the Preferred Embodiments

In the accompanying drawing, there is schematically depicted a production line 10 to powder coat articles formed of plastics material. The production line 10 includes a conveyor 16 having a portion 17 from which coated articles are removed, and a portion 18 at which articles are attached to the conveyor 16, for delivery to the cleaning booth 11.

From the cleaning booth 11, the articles are conveyed to the oven 12 and more particularly the pre-heating portion 14 of the oven 12. After pre-heating, the articles are conveyed to the spray booth 13 wherefrom they are returned to the oven 12 and more particularly, the baking portion 15 thereof.

The oven 12 is provided with oven doors that are intermittently opened to enable particulars to enter the oven 12. Accordingly, the conveyor 16 is intermittently operated and coordinated with the oven doors.

In the following preferred embodiment, it should be appreciated that the articles of reinforced plastics material are being pre-heated to a temperature which is the same temperature at which the articles are baked after being powder coated. As can also be observed from the attached drawing, the conveyor 16 has a greater length in the pre-heating portion 14 relative to the portion 15. Accordingly, the articles spend a greater length of time in the pre-heating portion 14 relative to the baking portion 15. In the following preferred embodiment the articles spend approximately three times the period that the articles spend in the baking portion 15.

An article of plastics material is provided and the passed through the cleaning booth 11. The article is heavily reinforced by fibres such as glass, ceramic or carbon fibres. The fibres ensure that the article does not deform beyond predetermined limits when preheated.

The article is preheated in the oven 12 to a predetermined temperature which is determined by the properties of the polyester powder coating material to be applied to the article. The article is preheated to a temperature approximating the temperature at which the powder melts. The article is then conveyed to the spray booth 13.

5 Within the booth 13 an air stream containing the powder is directed at the article to cover at least a portion of the article with a coating. As the powder particles engage the article, the particles melt. This ensures that the polyester powder material stays attached to the article. To provide a proper coating, the stream needs to be directed to whatever area is to be coated.

10 Preheating also aids adhesion of the polyester layer to the article as "pores" on the surface of the article tend to open up as a result of heating. This allows the layer to penetrate the "pores" to ensure proper fixing of the polyester layer to the article.

Melting of the polyester powder material also eliminates problems in respect of powder "drop off" evident in electrostatic powder coating processes.

15 Curing is achieved by baking the article with its layer applied thereto in the oven 12. Preferably the article with its layer would be cured at a temperature of about 280° for approximately 30 minutes.

20 By pre-heating the article to the baking temperature, the powder commences "curing" prior to actually entering the baking portion 15 of the oven 12. In that regard, it should be appreciated that the spray booth 13 is separated from the oven 12 by means of timed doors which open on demand and are coordinated with movement of the conveyor 16. Operation of the doors helps in maintaining the optimum curing temperature.

25 Figure 2 of the accompanying drawings is a modification of the production line 10 of Figure 1. In Figure 2 the same reference numerals have been employed relative to Figure 1.

30 In the embodiment of Figure 2 the conveyor 16 may be intermittently or continuously run. If intermittent, the line would have a predetermined index rate. Clearly, the index rate or speed of a continuously running conveyor will determine the amount of time each article spends at the various stations.

The cleaning booth 11 of Figure 2 includes a line stem-cleaning unit.

35 The pre-heating portion 14 heats the articles for a period of time that must satisfy two requirements. Firstly, the articles must be heated to the extent that their moisture content is zero. Secondly, as mentioned previously, the articles must have a surface temperature which is at least approximately the melt temperature of the powder to be applied. Typically, an article would remain in the pre-heat portion 14 for a period of 15 to 30 minutes

Typically, for the conditions in respect of pre-heating to be met, the oven 12 would need to have ambient temperature in the range of 205 to 235°C. The articles

would need to have a temperature of from 110 to 150°C, preferably 125 to 140°C but more preferably 130 to 135°C.

In the baking portion 15 the articles are cured so as to have a temperature within the temperature range of 190 to 215°C. An optimum temperature has been to be
5 206°C for a baking period of 18 minutes. The curing temperature and the characteristics of the power coating material determines the curing time. Typical curing times range between 15 and 30 minutes.

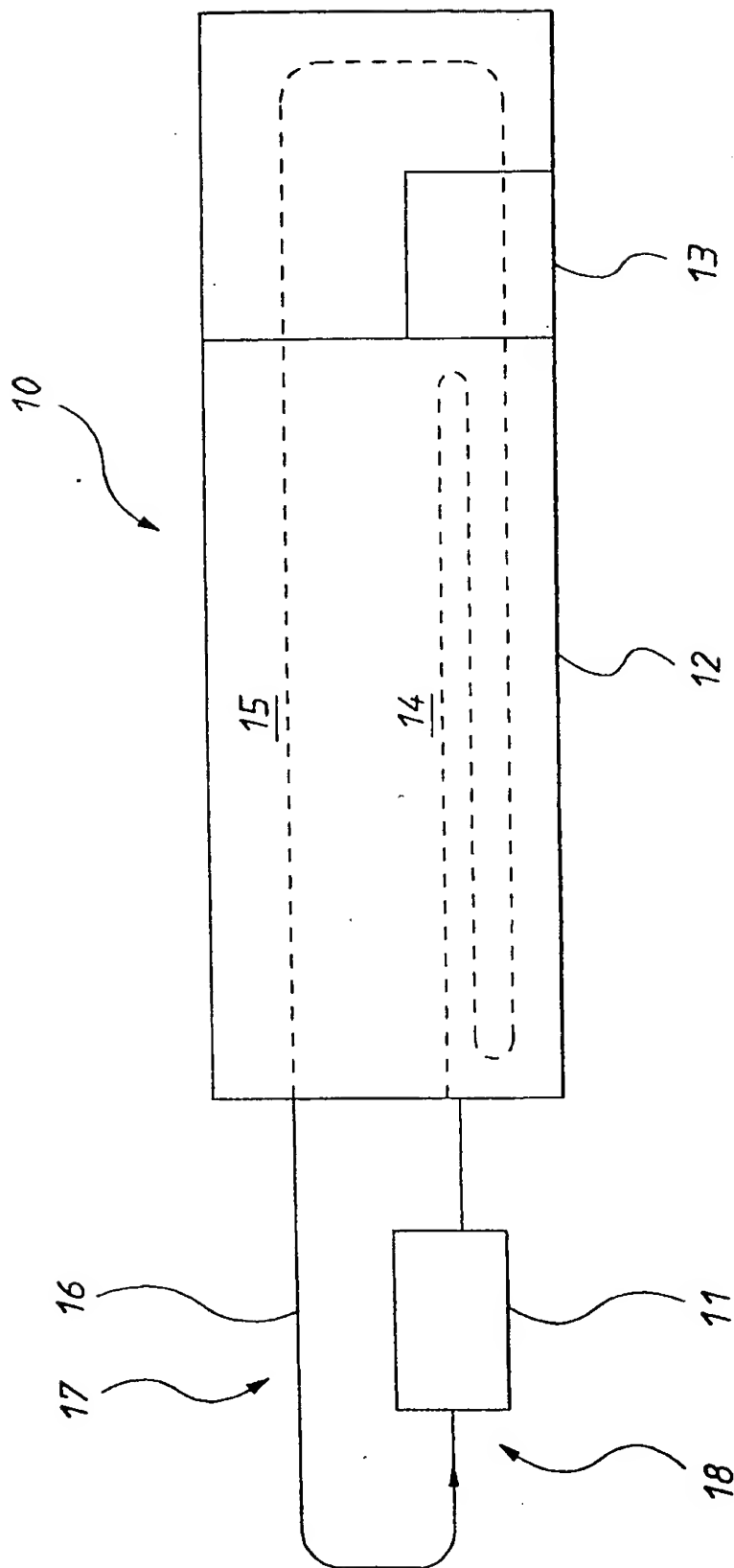
In the above preferred embodiments the articles being coated are typically heavily reinforced by fibres such as glass, ceramic or carbon. The fibres insure that the
10 articles do not deform beyond predetermined limits when passing through the oven 12.

In the embodiment of Figure 2, the spray booth 13 is associated with a return enclosure 18 through which the conveyor 16 passes to convey the articles from the booth 13 to the oven portion 15.

CLAIMS:

1. A method of forming a polyester coating on at least a portion of an article of plastics material reinforced with fibre, said method including the steps of:
providing said article;
5 pre-heating said article to a predetermined temperature, which predetermined temperature is at least equal to the melting temperature of polyester powder which is to form the coating;
providing a stream of said powder;
directing said stream at said portion to apply the powder thereto whereupon
10 said powder melts to form said coating; and
curing the coating.
2. The method of claim 1 wherein curing the coating is carried out at a temperature of about 280° for at least 20 minutes.
3. The method of claim 1 or 2 wherein curing is carried out at a
15 temperature of about 280° for approximately 30 minutes.
4. The method of claim 1 wherein the items are cured at a temperature of 190° to 250°C.
5. The method of claim 4 wherein the articles are cured at a temperature of 190° to 215°C.
- 20 6. The method of claim 5 wherein the articles are cured for 15 to 30 minutes.
7. The method of claim 6 wherein the articles are cured at a temperature of about 206° for approximately 18 minutes.
8. The method of any one of claims 1 to 7 wherein the articles are pre-
25 heated to a temperature of 110 to 150°C.
9. The method of claim 8 wherein the articles are pre-heated to a temperature of 125° to 140°C.
10. The method of claim 9 wherein the articles are pre-heated to a temperature of 130° to 135°C.
- 30 11. The method of any one of claims 1 to 10, wherein the articles to be coated are reinforced by fibres.
12. A method of coating articles substantially as hereinbefore described with reference to Figure 1 or Figure 2.

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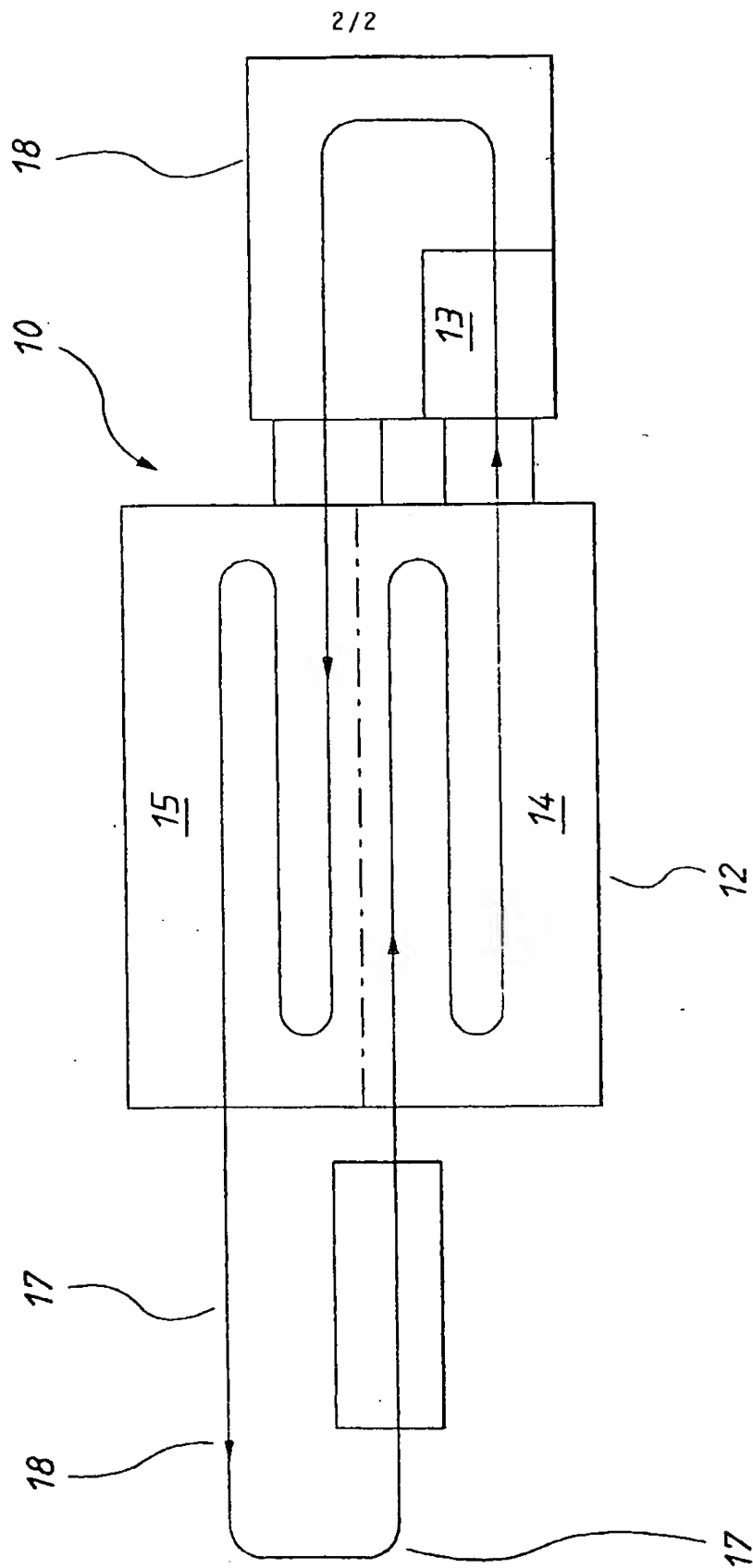



FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 99/00299

A. CLASSIFICATION OF SUBJECT MATTER		
Int Cl ⁶ : B29C 41/08, 41/46		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) B29C 41/08, 41/46, 71/00, 25/00, B29D 9/08, B05D 7/02, C08J 7/04		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT: IPC as above and keywords		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5338578 A (LEACH) 16 August 1994 Claims 1 and 13, column 2 lines 29-42, column 3 lines 34-39 and 50-58, column 5 line 3 - column 6 line 2	1-12
X	US 5021297 A (RHUE et.al.) 4 June 1991 Claims, column 1 lines 63-68, column 2 lines 11-19, column 2 line 64 - column 4 line 16	1-12
X	US 5344672 A (SMITH) 6 September 1994 Claims, column 4 line 64 - column 5 line 16, column 5 lines 32-52, column 7 line 61 - column 8 line 16	1-12
<input type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>		
Date of the actual completion of the international search 4 May 1999		Date of mailing of the international search report 11 MAY 1999
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (02) 6285 3929		Authorized officer  M. BREMERS Telephone No.: (02) 6283 2052

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
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This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search. Report				Patent Family Member			
US	5021297	AU	44652/89	BR	8906075	CA	2001560
		EP	372740	JP	2194878		
US	5344672	US	5565240				
							END OF ANNEX